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SUMMARY REPORT OF THE TASK FORCE ON TRAINING TECHNOLOGY.(U)
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(6) SUMMARY REPORT OF THE TASK FORCE ON TRAINING TECHNOLOGY

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Office of the Director of Defense Research and Engineering - Washington, D. C.

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

26 February 1976

TO: THE SECRETARY OF DEFENSE

THROUGH: THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

The attached summary report of the Defense Science Board Task Force on Training Technology was prepared at the request of the Director of Defense Research and Engineering. The Task Force, under the Chairmanship of Dr. Earl A. Alluisi, consisted of members with a wide range of experience in training, education, and management. A recommended implementation plan has been developed by Dr. Alluisi and the Defense Science Board Management Panel, under the Chairmanship of Dr. Richard D. DeLauer.

Both the report and the implementation plan emphasize the need for cost-effectiveness analyses of Service training alternatives, and the principal recommendation of each deals with this issue. The availability and use of such analyses are fundamental to improving decisions about training and providing guidance for the directions to be taken in training technology research and development. Other recommendations address less fundamental issues such as crew, group, team, and unit training, management information categories for training technology, and the centralized management with decentralized operations of training technology research and development. As you know, many of the Task Force's recommendations are already being acted upon by your staff.

The report has been approved by the Defense Science Board and I recommend it to you for your consideration.

Solomon J. Buchsbaum
Chairman
Defense Science Board

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

16 February 1976

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: A Recommended Plan for Implementation of the Recommendations of the Task Force on Training Technology

I am pleased to forward to you the final summary report of the Task Force on Training Technology. The report emphasizes the need for analyses of the cost-effectiveness of training alternatives. Other recommendations, dealing with both management and substantive issues, are clearly secondary to this major need. In order to implement the general recommendations of the Task Force's summary report, the Defense Science Board Management Panel and the Task Force Chairman recommend the following specific actions:

1. The Secretary of Defense should request each of the Military Departments to prepare plans to assess Service training alternatives in cost-effectiveness terms. Priority in the analysis should be given to (1) flight training, (2) specialized skill training, and (3) Army recruit training because of the high costs or high student loads of such training.

a. The analysis should document the impact of training technology on current as well as alternative Service training. It should include considerations of (1) the training requirements, (2) current training programs designed to meet these requirements, (3) cost-effectiveness (both cost-benefits and performance-effectiveness) improvements already achieved through implementation of new training technology, (4) identification of training alternatives most likely to produce improved cost-effectiveness ratios by the additional implementation of existing new training technology, and (5) specification of areas of training most likely to benefit from appropriate Training Technology R&D, e.g., because of identified relatively high costs or low performance effectiveness.

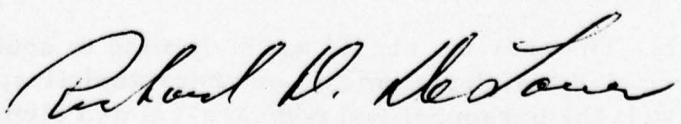
b. The analysis should not be limited to equipment or hardware-related training elements or characteristics, but should include as well the personnel and software-related elements. Changes resulting from effective use of new training technology should be considered as they impact the training requirements, the training, and the Services' personnel management systems, including such elements as the definitions of job categories and skill levels, special ratings, career patterns, and assignment procedures.

c. The plans should be presented by the Military Departments no later than 1 July 1976, with assessments to begin by 1 October 1976. An appropriate Assistant Secretary of Defense should be designated as the point of contact for information within the Office of the Secretary of Defense.

2. The Secretary of Defense should instruct the Assistant Secretary of Defense (Program Analysis and Evaluation) to provide guidance to the Military Departments to commit a proportion of the resources proposed for crew, group, team, and unit (CGTU) training (1) for implementation of existing new training technology in CGTU training, and (2) for operational assessments of the effectiveness thereof. The commitment should be substantial (e.g., not less than 5%), to ensure a valid data base for analyses of the training alternatives. Training cost-effectiveness analyses, such as those called for in recommendation #1 above, should be employed to the fullest extent possible by the Services in their evaluation of CGTU training.

3. The Director of Defense Research and Engineering should instruct the Deputy Director (Research and Advanced Technology) to institute a means of relating the management information categories of the human resources (training and personnel technology) technology coordination paper (TCP), the functional areas of training, the RDT&E program, and the DoD budget as called for in the Task Force's General Recommendation No. 2. The Military Departments' Assistant Secretaries (Research and Development) should be asked to establish comparable means in support of this goal, as should the Director of the Defense Advanced Research Projects Agency. The necessary transfer (or transformation-matrix) functions should be developed by the beginning of FY 1977 and maintained for consistency to relate the program element, project, and task area program/budget structure to the TCP technology category and subcategory, and to the divisions according to the functional area of training.

4. The Management Panel endorses the Task Force's recommendation of centralized management and decentralized operations of Training Technology R&D, and expects specific implementation plans to be included in the Medical and Human Resources Laboratory Utilization Study now being completed in the Office of the Director of Defense Research and Engineering.



Richard D. DeLauer
Chairman
DSB Management Panel

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

16 June 1975

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Summary Report of the Task Force on Training Technology

I am pleased to submit to you the final summary report of the Task Force on Training Technology. This report summarizes the findings, conclusions, and recommendations of the Task Force. It is based on studies begun in July 1974 and more fully reported in the Task Force report of 31 May 1975. It also reflects comments and suggestions provided by Task Force members and from others within the Department of Defense and in education and training fields who had an opportunity to review the report during its preparation.

Our summary report places considerable emphasis on the need for cost-effectiveness analyses of training, and the benefits or potential benefits that could accrue from the timely and appropriate implementation of findings from training technology research and development. We recognize that training cost-effectiveness ratios constitute but one aspect of the military manpower personnel management system. Nevertheless, the Department of Defense is committed to the acquisition, effective use, and retention of the required numbers of qualified, motivated, and trained personnel to man its planned forces with optimum operational readiness and performance efficiency at minimum cost. Training technology research and development must be managed in such a way as to contribute maximally to these ends. Our recommendations are directed towards that objective.

I would like to express my appreciation for the excellent cooperation that the Task Force has received from all quarters during the period of its investigation, and also to recognize the many outstanding contributions that were made by all of its members, its staff, and those persons who served as liaison points-of-contact and respondents from the Office of the Secretary of Defense and the Military Departments.

Earl A. Alluisi
Chairman, Task Force on Training Technology

EXECUTIVE SUMMARY

The DoD's training requirements are enormous and costly. During FY 1976, 1.7 million officer and enlisted personnel will complete some type of formal military training at a cost in excess of $7.1 billion. About 17% of the military man-years of effort available to DoD will be devoted to such training--10% as trainees and 7% as instructors or in other training-support functions.

The cost per graduate varies with the type and duration of training, from low costs in some Functional Training (1-12 days) to $2900 in Recruit Training (54 days) and $125 thousand in military Flight Training (201 days). Where comparisons can be made, e.g. in Specialized Skill Training, the military costs of about $25 thousand per trainee man-year are similar to those typical of industry training for specialties such as semi-conductor theory and airline ground school --$28 and $46 thousand per paid trainee man-year, respectively. This says nothing about the efficiency or the cost-effectiveness of the training. Personnel in industry appear to spend less time in direct training during their careers than do those in the military. Industry tends to provide for the desired growth in employee capabilities more through week-end workshops, short courses, and relevant on-the-job experiences.

These data relate to individual training and education in formal courses by organizations whose predominant mission is training. They exclude the costs of on-the-job training and procurement of training courses and equipment for new weapon systems. They do not include the training of organized crews and units for the performance of specific military missions (i.e., "operational training" or "force support training"). Thus, the total cost of military training, which must include some aspects of field exercises and operational activities that promote readiness, is very large indeed.

At $32.4 million, the requested FY 1976 funds for technology-base R&D on training technology are equivalent to 0.05% of total DoD outlay, 0.1% of DoD personnel costs, and less than 0.5% of total DoD RDT&E. The level of funding is quite low, especially in relation to the high costs of the problem area this R&D addresses. Apart from the technology-base efforts that are managed as part of the Human Resources R&D program, other R&D on training technology is estimated to amount to an additional $160 million in FY 1976.

The Task Force examined the R&D programs of the Services and DARPA in each of the following six functional areas of training: (I) Recruit Training, (II) Specialized Skill Training, (III) Officer Acquisition Training and Professional Development Education, (IV) Flight Training, (V) Weapon System Training Subsystem Development, and (VI) Crew, Group, Team, and Unit (CGTU) Training. Extensive data were provided by the laboratories concerned with R&D on training equipment and procedures, by the training commands, training equipment program managers (PM's) and system project offices (SPO's), ASD(M&RA), and to a lesser extent by industrial sources. The summary findings and general recommendations follow.

Defense training is apparently effective: trainees complete courses and are assigned to operational units in the numbers required to operate and maintain the DoD's weapon systems. However, with few exceptions, almost no training cost-effectiveness ratios are employed in OSD or the Military Departments. As a consequence, the DoD cannot presently assess the true impact of alternative training systems, and ODDR&E cannot assess the true or potential worth of its R&D program on training technology. In addition, non-corresponding management information categories are employed in the major OSD documents relating to training and R&D on training; this makes it difficult to determine which R&D areas are more likely to produce beneficial cost-effective results. To improve the effectiveness of training and Training Technology R&D, the DoD should:

1. DEVELOP A CAPABILITY TO PERFORM COST-EFFECTIVENESS ANALYSES OF TRAINING TECHNOLOGY.

2. ESTABLISH A MEANS OF RELATING THE MANAGEMENT INFORMATION CATEGORIES OF THE HUMAN RESOURCES TECHNOLOGY COORDINATION PAPER (TCP), THE FUNCTIONAL AREAS OF TRAINING, THE RDT&E PROGRAM, AND THE DOD BUDGET.

There is no compelling evidence to suggest there exist significant duplications of Training Technology R&D efforts. Whether the distribution of these efforts is directed toward the problems of greatest potential benefit cannot be determined without the needed comparative cost-effectiveness analyses. There is insufficient assessment of advanced training methods and prototype training equipment and simulators. This is due in part to the nonavailability of training personnel and facilities for test purposes, and to the limited representation of R&D personnel at the training locations for such tests. Likewise, the development and procurement of training subsystems for weapon systems take place with insufficient input by personnel responsible for Training Technology R&D. A similar situation exists with the acquisition of large-scale nonsystem training equipment. The lag in implementation of Training Technology R&D findings by the training and operational commands and by the PM/SPO's can be attributed largely to insufficient working arrangements between the R&D and user communities. The most successful instances of appropriate implementation and maintenance of changes have occurred where R&D on training technology has been colocated with its user. In light of these findings, the DoD should:

3. MANAGE TRAINING TECHNOLOGY R&D CENTRALLY AS PART OF HUMAN RESOURCES R&D, WITH DECENTRALIZED R&D OPERATIONS GEOGRAPHICALLY COLOCATED WITH MAJOR USERS, REPRESENTATION AT INTERMEDIATE LEVELS OF R&D AND USER COMMANDS, AND USER COMMITMENTS TO MUTUAL SUPPORT.

R&D on training methods is competent, relevant to the needs of the Services, and incorporates the current state-of-the-art in training devices, procedures, and data processing. The Services have pioneered (a) in the use of complex simulators

to train personnel to operate and maintain major weapon systems, (b) in self-paced personalized methods of instruction, (c) in performance-oriented training, and (d) in managing the training of very large numbers of individuals. However, insufficient attention is now being given to collective training, i.e., to the training of crews, groups, teams, and units. This is an area in which significant improvements in efficiency and effectiveness are now possible. Therefore, the Task Force recommends that the DoD should:

4. INCREASE TECHNOLOGY-BASE FUNDS FOR TRAINING TECHNOLOGY R&D IN SUPPORT OF CREW, GROUP, TEAM, AND UNIT (CGTU) TRAINING.

The introduction of more-efficient training methods often poses problems for the commanders of training facilities because it may lead to reductions of support personnel or budgeted funds. Legal constraints such as time-in-training criteria rather than performance-based criteria may discourage the development or adoption of more-efficient training methods and curricula. Insufficient attention has been given to ways of providing incentives and of eliminating existing disincentives for improving the efficiency of training. The DoD must:

5. CHANGE ADMINISTRATIVE AND MANAGEMENT POLICIES AND PRACTICES WHEREVER POSSIBLE TO PROVIDE GREATER INSTITUTIONAL INCENTIVES FOR THE DEVELOPMENT, TRANSFER, AND USE OF COST-EFFECTIVE TRAINING TECHNOLOGY.

Certain related topics, some of which may merit future attention, were not addressed in detail by the Task Force, largely because of limitations in the time and scope of this effort. These include the following: (a) training in the Services' operational commands, (b) on-the-job training, (c) human-factors aspects of training, (d) commercial contract training, (e) foreign military training, (f) the advantage of laboratory versus headquarters locus for management of contract or grant Research (6.1) on training technology, (g) the balance of in-house versus contract efforts in Training Technology R&D, and (h) the personnel and human-factors parts of the Human Resources R&D program.

MEMBERSHIP

Defense Science Board Task Force on Training Technology

Earl A. Alluisi, Old Dominion University (Chairman)

O. S. Adams, Lockheed-Georgia Company

Davis B. Bobrow, University of Maryland

Ralph Flexman, University of Illinois

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Howard H. McFann, HumRRO Western Division

Jesse Orlansky, Institute for Defense Analyses

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Staff

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SUMMARY REPORT OF THE TASK FORCE ON TRAINING TECHNOLOGY

INTRODUCTION

The Task Force on Training Technology was convened in July 1974 at the request of the Director of Defense Research and Engineering (DDR&E). The Secretary of Defense had noted in the Annual Defense Department Report, FY 1975, that while individual training is a fundamental prerequisite to combat readiness, it is also expensive, making very high demands on scarce resources. In monetary terms, individual training costs in excess of $6 billion each year. In manpower terms, about one-sixth of all military personnel--students and trainees, instructors and support personnel--are engaged in the training mission and therefore are not available for duty in operational units.[1/] The Task Force was asked to evaluate the current effectiveness of DoD programs and management in the R&D area of training technology, with the objective of providing technical, management, and operational guidance in reducing costs and increasing effectiveness and efficiency of DoD training.

The Task Force was instructed to take a comprehensive view of Training Technology R&D, to include work in training systems, methods, procedures, media and software as well as training equipment, devices, aids, and simulators. It was asked to address specifically the following issues:

- Procedures to establish Training Technology R&D requirements and priorities within OSD and the Military Departments.

- Technical, administrative and managerial capability to provide responsive Training Technology R&D programs that address critical DoD training and education problems with maximum efficiency for minimum costs with explicit assessment of (a) the degree of integration across DoD, (b) the extent of overlap or duplication, (c) the presence of gaps, (d) flexibility and timeliness of responsiveness, and (e) possible consolidations of Training Technology R&D programs or facilities.

- Approaches to expedite application and implementation of Training Technology R&D output.

In addition, the Task Force was asked to evaluate alternative management approaches and structures in view of the objective and issues, and to make appropriate recommendations where indicated, such evaluation to include explicit assessment of the extent to which there should be developed within specific Training Technology R&D areas (a) a common Training Technology R&D Program for all

Military Departments, (b) lead-service programs in terms of initiative and leadership with down stream modification and application to other Services, or (c) separate Service programs with emphasis on coordination of major thrusts.

For the purposes of this Task Force, Training Technology R&D included both that associated with weapon system development (e.g., equipment components and subsystems, devices, simulators, job guides, mock-ups, and other training media for both operations and maintenance) as well as prototype nonsystem development (e.g., devices, lessons, or software for technical schools and/or on-the-job training).[2/]

To carry out its assignment, the Task Force worked over the 12-month interval from July 1974 to June 1975. DoD training and education was reviewed in terms of the six functional categories that are defined below:

- Recruit Training, the initial individual training of all enlisted entrants to the Services who have not had prior military Service.

- Specialized Skill Training, the subsequent individual training of both officer and enlisted personnel to provide new or higher levels of skill in military specialties to match specific job requirements.

- Officer Acquisition Training, the individual education and training that leads to a commission in one of the Services, and Professional Development Education, the individual education conducted at the higher-level Service schools or at civilian institutions to broaden the outlook and knowledge of senior military personnel or to impart knowledge in advanced academic disciplines to meet Service requirements.

- Flight Training, the individual training in basic flying skills to provide the Services with pilots and navigators for initial assignments to operational-mission units.

- Weapon System Training Subsystem Development, the development of the requirements, materials, and programs for both individual and collective training of operational and maintenance personnel needed in support of weapon system acquisition and use.

- Crew, Group, Team, and Unit (CGTU) Training, the collective training of elements of operational units.

All except the last two are categories included in the annual Military Manpower Training Report.[3/] These two were included because of their importance as training elements that impact on operational readiness.

To the extent possible, each area was examined with identical methods and procedures. Six members of the Task Force assumed leadership responsibilities --one in each of the areas--both in the development of specific questions and issues, and in drafting the relevant chapters of the Task Force Report; they are identified with the chapters. The Task Force examined the following aspects of each area:

- Scope of training requirements and costs.
- Description of the training programs.
- Scope of the Training Technology R&D support of the training programs.
- Analysis and evaluation of current Training Technology R&D programs and management: (a) in establishing requirements and priorities, (b) in technical and administrative capability to provide responsive programs, and (c) in approaches to expedite applications and implementations of Training Technology R&D output.
- Consideration (analysis and evaluation) of issues unique to the topical area, and of alternate managerial approaches or structures to increase the cost-effectiveness of training and Training Technology R&D.

The questions formulated by the Task Force were reviewed with representatives of the Military Departments, revised as appropriate, and submitted for formal responses. Beginning in September 1974 and continuing for six months through February 1975, the Task Force met for two or three days each month with representatives of OSD and the Military Departments in order to discuss the topical area, to clarify the interpretations of the written responses from the Services, to present any additional questions that appeared necessary, and to provide the Services the opportunity to add additional data or call the Task Force's attention to additional issues. The meetings were supplemented by visits to selected Service installations. Finally, drafts of the chapters were reviewed and jointly discussed by all Task Force members and staff.[4/]

The Task Force on Training Technology is the latest in a series of Defense Science Board Task Forces that have examined various aspects of R&D management and manpower-related R&D. Previous studies include the (a) Task Force on Research and Development Management (1969), (b) Task Force on Manpower Research (1970-71), and (c) Task Force on Electronics Management (1973-74). Although these have been beneficial to the present study, none has dealt specifically with the management of training and Training Technology R&D.

Other current efforts related to the work of this Task Force on Training Technology include the following: (a) the Laboratory Utilization Study, a joint OSD/Military Department investigation of the in-house laboratories, (b) the Committee on Excellence in Education's review of DoD educational programs including officer acquisition training and professional development education, (c) the Inter-Service Training Review Board's continuing examination of broad training issues for possible combinations of training courses, capabilities, and facilities, (d) the Joint Directors of Laboratories Study of Training Devices and Simulators, a special review of training device and simulator R&D for possible duplications and overlaps with the view of establishing lead-Service responsibilities where indicated, and (e) the Defense Science Board Task Force on Technology Base Strategy, a group recently convened to assess the distribution of technology-base R&D across substantive areas. None of these efforts duplicates the work of this Task Force on Training Technology.

In approaching its work, the Task Force concluded that it should examine the following major problems:

- The high costs of current training, in manpower, equipment, and monetary terms.
- The extent to which training effectiveness can be maintained or improved with cost savings through implementation of advanced training technology.
- The way in which management or program changes in Training Technology R&D could accelerate improvement of the training cost-effectiveness ratio.

Scope of Defense Training

The FY 1976 DoD budget includes an estimated outlay of some $49.2 billion for personnel costs, representing 53% of the total DoD outlay. As shown in Table 1, the general trend over the last decade or so has been for increasing manpower costs in both absolute and relative terms, even with the decrease of 34% in total manpower from FY 1968 to the present. The drop in personnel costs from FY 1975 to FY 1976 is relative, but not absolute, and reflects inflationary increases in materiel costs.[5/]

Training costs account for a significant proportion of total personnel costs. For example, as shown in Table 2, training accounts for about one-third of DoD centrally managed military personnel activities, a category that is about 21% of the FY 1976 DoD Direct Program Total Obligational Authority of $104.7 billion.[6/] Approached from a different direction, the DoD funding for individual training and education programs has been running to about 8% of total DoD outlays as shown

TABLE 1

DOD OUTLAY FOR PERSONNEL, AND MANPOWER TRENDS [5/]
(Outlay in $ Billions, Manpower in Million Man-Years)

	FY 1964	FY 1968	FY 1973	FY 1974	FY 1975	FY 1976
Total DoD Outlay	50.8	78.0	73.8	79.5	85.8	92.8
DoD Personnel Costs: Military, Civil Service, and Retired Military Pay and Allowances (% of Total)	22.0 (43.8%)	32.6 (41.8%)	41.2 (55.8%)	43.9 (55.2%)	47.5 (55.4%)	49.2 (53.0%)
Other than Personnel (% of Total)	28.8 (56.7%)	45.4 (58.2%)	32.6 (44.2%)	35.6 (44.8%)	38.3 (44.6%)	43.6 (47.0%)
Total DoD Manpower	3.7	4.7	3.4*	3.2	3.2	3.1
Military	2.7	3.4	2.3*	2.2	2.2	2.1
Civil Service	1.0	1.3	1.0*	1.0	1.0	1.0

*Does not add to total because of rounding.

[5/] See Note 5 for source(s).

TABLE 2

TOTAL OBLIGATIONAL AUTHORITY FOR DOD CENTRALLY MANAGED MILITARY PERSONNEL ACTIVITIES [6/]
(In $ Billions)

	FY 1974	FY 1975	FY 1976
Training, Medical and Other General Personnel Activities	18.2	19.9	21.7
Training (% of Total)	6.2 (34.1%)	6.5 (32.7%)	6.5 (30.0%)
Other than Training (% of Total)	12.0 (65.9%)	13.4 (67.3%)	15.2 (70.0%)

[6/] See Note 6 for source(s).

TABLE 3

DOD FUNDING FOR INDIVIDUAL TRAINING AND EDUCATION PROGRAMS [7/]
(In $ Billions)

Individual Training & Education	FY 1974	FY 1975	FY 1976
Direct Programs	6.31	6.77	6.80**
Supplemental Programs*	0.27	0.30	0.32**
Total (% of Total DoD Outlay from Table 1)	6.58 (8.3%)	7.07 (8.2%)	7.11** (7.7%)

* Includes items not requiring authorization of average military student training loads such as ROTC, Armed Forces Health Professional Scholarship, Flight Familiarization, and Off-Duty and Voluntary Education programs.
** Does not add to total because of rounding.

[7/] See Note 7 for source(s).

in Table 3 for both direct and supplemental programs over the three years, FY 1974 through FY 1976.

The value of operational equipment exclusive of aircraft, tanks, and ships used for training in 1972 was estimated to be approximately $4.5 billion; this is the estimated value of the inventory and does not include the large repair costs for damage to operational equipment being used for training. The inventory of training aids, devices, equipment and simulators used in lieu of operational equipment, often with increased training effectiveness, was worth about one-quarter of this amount--approximately $1.2 billion.[8/]

In the individual training and education areas of Recruit Training and Specialized Skill Training alone, the time to be spent in training by the successful trainees--those who graduate from the programs--is estimated to be equivalent to at least 210 thousand man-years during FY 1976. This is shown in Table 4.[9/] Attrition and recycling of trainees would account for additional training time spent in these two areas. In fact, the total manpower commitments to individual training and education--students and trainees, instructors, and support personnel--amount to about one-sixth of all military personnel. This is shown for the past decade in Table 5.[10/]

It is important to understand that where data are given for "individual training and education," as in Tables 4 and 5, they pertain solely to the training of individual military members in formal courses conducted by organizations whose predominant mission is training. Such data do not include training activities conducted by operational units incidental to their primary combat, combat support, or combat service support missions. The training of organized crews and units for the performance of specific military missions ("operational training" or "force support training") is not included in the Military Manpower Training Report,[3/] and the costs of such training are not included where "individual training and education" is being analyzed. Likewise, in certain categories of training, on-the-job training (OJT) in units is used to supplement or partially to substitute for formal course-training requirements; the costs of such OJT are generally not included in summaries of individual training and education. Thus, the estimates of the costs of current training presented in the preceding tables must be interpreted as quite low and conservative estimates. By any method of reckoning, the costs of current DoD training are extremely high.

Scope of Defense Training Technology R&D

The FY 1974, FY 1975, and requested FY 1976 funds for DoD Research, Development, Test and Evaluation (RDT&E) are shown in Table 6. Also shown are the funds for the total and the "Education and Training" part of the Human Resources R&D program. These "Education and Training" funds represent the program area in which the Task Force study was concentrated. This program is centrally managed

TABLE 4

DOD GRADUATE-TRAINEE MAN-YEARS IN RECRUIT AND SPECIALIZED SKILL INDIVIDUAL TRAINING, FY 1976 9/

Type of Training	Number of Graduates	Weighted Average Course Length (Years)	Graduate-Trainee May-Years in Training During FY 1976
Recruit	445,623	0.150	66,843
Specialized Skill	1,188,314	0.121	143,786
Total	1,633,937	0.128909	210,629

9/ See Note 9 for source(s).

TABLE 5

DOD MANPOWER ENGAGED IN INDIVIDUAL TRAINING AND EDUCATION 10/
(Military End-Strength, in Thousands)

	FY 1964	FY 1968	FY 1971	FY 1972	FY 1973	FY 1974*	FY 1975*
Manpower	403	700	507	405	354	364	341
As Percentage of Total Military Strength	15.0%	19.8%	19.9%	17.5%	15.6%	16.6%	15.8%

*Estimated

10/ See Note 10 for source(s).

in ODDR&E through the Assistant Director for Environmental and Life Sciences [AD(E&LS)], in the directorate responsible for technology-base R&D management, that of the Deputy Director for Research and Advanced Technology [DD(R&AT)].

The "technology-base" programs include Research (6.1), Exploratory Development (6.2), and some Advanced Development (6.3A, or that 6.3 which is nonsystems-related Advanced Development). These programs are performed primarily in the R&D laboratories and are centrally managed as areas of technology in ODDR&E.

"Nontechnology-base" programs include the remaining Advanced Development (6.3), Engineering Development (6.4), Management and Support (6.5), and Operational Systems Development. Generally, they are programs to implement and apply findings from technology-base R&D. Much of this work is performed through contracts managed by System Project Offices (SPO's) or Program Managers (PM's) for specific weapon system developments. The training technology aspects of such nontechnology-base programs are generally not managed as part of the Training Technology or Human Resources R&D programs.

The "Education and Training" R&D funds shown in Table 6 constitute about one-half of the Human Resources R&D program funds. About two-thirds of this is technology-base R&D. The one-third that is not technology-base R&D consists essentially of a program element in each of the Military Departments at the Engineering Development (6.4) level for nonsystems training devices and simulator development.

The Task Force reviewed some of the many training subsystems that are included within weapon system development programs managed by specific PM/SPO's. However, it did not review other nontechnology-base Training Technology R&D efforts that are not managed as part of the Human Resources R&D program. The monetary value of such efforts for which in ODDR&E there is neither central technological area management nor organizational mechanisms for central technological area cognizance is estimated to be on the order of $160 million.[12/] This is between three and four times the $47.5 million requested in FY 1976 (cf. Table 6) for the Training Technology R&D that is part of the Human Resources R&D program.

The percentages given in the lower part of Table 6 show the funding of total DoD RDT&E, Human Resources R&D, and Training Technology R&D programs relative to total DoD outlay, DoD personnel costs, and total DoD RDT&E. If the percentages listed under the "Education and Training" columns are increased by a factor of between 4.0 and 4.5, they will reflect the inclusion of all Training Technology R&D efforts as estimated in the preceding paragraph.

Thus, the requested FY 1976 funds for centrally managed Training Technology R&D are equivalent to 0.05% of total DoD outlay, 0.1% of DoD personnel costs, and less than 0.5% of total DoD RDT&E. The respective percentages estimated

TABLE 6

FUNDING OF DOD, HUMAN-RESOURCES, AND TRAINING-TECHNOLOGY RDT&E [11/]
(In $ Millions)

	FY 1974			FY 1975			FY 1976		
	DoD	Hu Res	Ed&Tng	DoD	Hu Res	Ed&Tng	DoD	Hu Res	Ed&Tng
Technology Base RDT&E	1,386.5	58.8	27.0	1,415.5	62.5	28.3	1,610.5	74.8	32.4
(% of Total)	(16.9%)	(81.4%)	(74.4%)	(16.4%)	(77.7%)	(66.9%)	(15.7%)	(77.4%)	(68.2%)
Non-Tech. Base RDT&E	6,808.3	13.4	9.3	7,200.0	17.9	14.0	8,626.1	21.2	15.1
(% of Total)	(83.1%)	(18.6%)	(25.6%)	(83.6%)	(22.3%)	(33.1%)	(84.3%)	(22.1%)	(31.8%)
Total RDT&E	8,194.8	72.2	36.3	8,615.5	80.4	42.3	10,236.6	96.0	47.5
Total RDT&E as % of:									
Total DoD Outlay [a/]	10.3%	0.09%	0.05%	10.0%	0.09%	0.05%	11.0%	0.10%	0.05%
DoD Personnel Costs [a/]	18.7%	0.16%	0.08%	18.1%	0.17%	0.09%	20.89%	0.20%	0.10%
Total RDT&E [b/]	100.0%	0.88%	0.44%	100.0%	0.93%	0.49%	100.0%	0.94%	0.46%

[11/] See Note 11 for source(s).
[a/] Cf. Table 1.
[b/] Cf. upper part of this table.

for all Training Technology R&D are 0.22% of outlay, 0.42% of personnel costs, and 2.01% of RDT&E. By all methods of reckoning, the funding of current DoD Training Technology R&D is quite low.

* * *

The remainder of this Summary Report is organized into two sections that summarize the General Findings and the General Recommendations, followed by six sections that deal with the six functional training areas considered separately in this study. These numbered sections (I-VI) contain the conclusions and specific recommendations from the six substantive chapters (III-VIII) of the full Task Force Report of 31 May 1975. There is obvious redundancy between the recommendations in these six sections and the General Recommendations that are based partly on them and partly on the general observations and findings.

The Task Force is confident that if DoD puts these recommendations into effect, the results will have significant impact on accelerating improvements in training cost-effectiveness ratios.

The six sections (and authors) are:

I. Recruit Training (Howard H. McFann)

II. Specialized Skill Training (Jesse Orlansky)

III. Officer Acquisition Training and Professional Development Education (H. Wallace Sinaiko)

IV. Flight Training (Ralph Flexman)

V. Weapon System Training Subsystem Development (O. S. Adams)

VI. Crew, Group, Team, and Unit (CGTU) Training (Joseph Rigney)

Finally, the Task Force prepared two memoranda for the Deputy Director of Defense Research and Engineering (Research and Advanced Technology): "Report of the Committee on a Defense Training Technology Center," dated 17 March 1975, and "Report of the Committee on the Navy AWAVS Location," dated 22 May 1975. These are appended to this Summary Report.

GENERAL FINDINGS

At the present time, there are with few exceptions almost no training cost-effectiveness ratios employed in OSD or the Military Departments. There are no cost-effectiveness functions that would permit the comparison of the current with alternative training philosophies, methods, procedures, equipments, and goals. As a consequence, the DoD cannot presently assess the true impact of alternative training systems, and ODDR&E cannot assess the true or potential worth of its Training Technology R&D program. The implication is both clear and disturbing --many important decisions are being made without adequate, valid, quantitative bases in fact. This is a serious gap: policy should demand the same sort of "hard" cost-effectiveness evidence with regard to training that is required for weapon system development and acquisition. Both better costing and better training-effectiveness assessment methods have to be developed and used.

It is difficult to determine except on an ad-hoc basis which specific areas of Training Technology R&D are more likely to produce beneficial cost-effective results. This is partly a result of the lack of correspondence in the management information categories employed in the major OSD documents relating to training and Training Technology R&D. The relevant documents of greatest importance are the annual Military Manpower Training Report, the Human Resources Technology Coordination Paper, the RDT&E Program, and the DoD Budget.

In light of the preceding, it is apparent that the identification of Training Technology R&D needs or requirements are dependent on subjective judgments made without benefit of findings from comparative cost-effectiveness analyses. Until this situation is corrected, it is especially important that the R&D community is involved to provide an input regarding the potentials and capabilities of training technology. Historically, such involvement has been best accomplished through close coordination and cooperation of Training Technology R&D and both training and operational user commands and working units.

Advances in the above three areas--cost-effectiveness analyses, correspondence in management information categories, and close R&D-user coordination--can lead to nontrivial improvements in the procedures to establish Training Technology R&D requirements and priorities within OSD and the Military Departments.

R&D on training methods is competent, relevant to the needs of the Services, and incorporates the current state-of-the-art in training devices, procedures, and data processing. The Services have pioneered (a) in the use of complex simulators to train personnel to operate and maintain major weapon systems, (b) in self-paced personalized methods of instruction, often computer assisted, (c) in performance-oriented training, and (d) in managing the training of very large numbers of individuals. However, insufficient attention is now being given to collective training, i.e., to the training of crews, groups, teams, and units. This is an area in which significant improvements in efficiency and effectiveness are now possible.

There is no compelling evidence to suggest there exist significant duplications of Training Technology R&D efforts, or that the present efforts are not related to Defense purposes. However, in the absence of the necessary comparative cost-effectiveness analyses, it is difficult to assess whether the distribution of these efforts is directed towards the problems of greatest potential benefit. There is insufficient assessment (testing and evaluation) of advanced training methods and of prototype training equipment and simulators. This is partly caused by the reluctance or inability of the commanders of training activities to make their personnel and facilities available for test purposes. The limited representation of Training Technology R&D personnel at the training locations for such tests also contributes to the deficiency.

The development and procurement of training subsystems for weapon systems take place with insufficient input by personnel responsible for Training Technology R&D. A similar situation exists with the acquisition of large-scale nonsystem training equipment. An estimated $2 to $3 billion may be spent for such equipment over the next several years. A "systems approach to training" (SAT) or "instructional systems development" (ISD) approach has been developed with DoD support. This approach is intended to ensure that the most cost-effective training methods and equipment will be developed and procured. The Air Force has led in the implementation of this SAT/ISD approach by establishing a policy that it will be employed on all current weapon systems and in the acquisition of all future ones. There is some question regarding the degree to which it is being correctly implemented, and there is little or no evidence of its actually producing cost-effective results.

The introduction of more-efficient training methods often poses problems for the commanders of training facilities because it may lead to reductions of support personnel or budgeted funds. Insufficient attention has been given to ways of providing incentives and of eliminating existing disincentives for improving the efficiency of training. "Profit-sharing" techniques might be adapted to these situations and adopted by OSD and the Military Departments.

The lag in implementation of Training Technology R&D findings by the training and operational commands and by the PM/SPO's can be attributed largely to insufficient working arrangements between the R&D and user communities. The most successful instances of appropriate implementation and maintenance of improvements have occurred where Training Technology R&D work has been colocated with its user, and such colocation should be continued and encouraged in the future.

Because of limitations in time and scope, the Task Force did not address in detail certain topics such as: (a) training in the Services' operational commands, (b) on-the-job training, (c) human-factors aspects of training, (d) commercial contract training, (e) foreign military training, (f) the advantage of laboratory versus headquarters locus for management of contract or grant Research (6.1) on training technology, (g) the balance of in-house versus contract efforts in this area, and (h) the personnel and human-factors parts of the Human Resources R&D program.

GENERAL RECOMMENDATIONS

The general recommendations of the Task Force on Training Technology are summarized as follows:

1. DEVELOP A CAPABILITY TO PERFORM COST-EFFECTIVENESS ANALYSES OF TRAINING TECHNOLOGY.

Interpretation

Effective management of training technology requires timely, well-based analyses of the cost-effectiveness of training alternatives. OSD needs the capability to secure such analyses in a timely manner to aid in Training Technology R&D decisions being made in several ODDR&E Directorates (Research and Advanced Technology, Strategic and Space Systems, and Tactical Warfare Programs), and to support other OSD decisions about training and the assessment of training alternatives. The approach of the Training Analysis and Evaluation Group (TAEG) of the Navy attests to the feasibility of training cost-effectiveness analyses being used to enhance the implementation of Training Technology R&D findings.

The analyses may be conducted, and the data bases maintained by combinations of offices or agencies in OSD and the Military Departments; e.g., in ASD (M&RA), ASD(I&L), ASD(PA&E), TAEG (Navy), TRAB (Air Force), and CATB (Army). ODDR&E should use the cost-effectiveness analyses and data bases as part of the information necessary to its management of Training Technology R&D programs, including analytical estimates of the potential impact of proposed new programs.

Reliable data bases are necessary for valid and useful cost-effectiveness analyses of training alternatives. Although considerable improvements have been made in the availability and quality of training data over recent years, additional efforts are needed to provide even better data, particularly if accurate cross-Service comparisons are to be made.

For example, the available data on expenditures for each trainee-day per graduate of Recruit Training differ greatly among the Services: $75 (in the Army), $37 (Navy), $45 (Marine Corps), $40 (Air Force), and $56 (DoD average). Part of the variation can be accounted for by course-content differences based on different service missions. Part can be explained by differences in attrition rates, and perhaps even by differences in efficiency. However, probably the major source of variation is attributable to accounting differences; e.g., to differing methods of allocating base operating-support costs, and to the inclusion or exclusion of trainee travel costs. Rectification of accounting conventions among the Services is a much-needed step in making possible more-rational decisions on training, training technology, and Training Technology R&D.

Where suitable data bases do not now exist, and where the responsibility for them is not organizationally clear, OSD should task the appropriate offices or agencies to establish and maintain them. ODDR&E should support R&D to improve the DoD's cost-effectiveness analyses, especially as applicable to training and training technology. (Specific recommendations II-1, II-4, III-2, III-3, IV-4, V-1, and V-2 bear on this general recommendation.)

2. ESTABLISH A MEANS OF RELATING THE MANAGEMENT INFORMATION CATEGORIES OF THE HUMAN RESOURCES TECHNOLOGY COORDINATION PAPER (TCP), THE FUNCTIONAL AREAS OF TRAINING, THE RDT&E PROGRAM, AND THE DOD BUDGET.

Interpretation

The Budget-Subactivity and Program-Element subdivisions are identical; they serve to relate the DoD-Budget and RDT&E-Program systems. The Project, Task Area, and Work Unit subdivisions constitute the further ordered levels below the Program Element in the programming system. Also, each Program Element is uniquely identified with a specific Military Department or Defense Agency. To provide more-effective management mechanisms, these Program/Budget subdivisions must be related as management information categories to the categories and subcategories of the Human Resources Technology Coordination Paper (TCP) and to the functional areas of training (and other Human Resources) activities.

Specifically, the Program Task Area subdivision should be identical to the TCP Program Work Statement of each TCP technology subcategory for both present and future (planned) programs. The Program Project subdivision should be identical to the functional areas of Service use, such as Recruit Training, Specialized Skill Training, and Flight Training in the general areas of training technology. A transformation matrix should be developed and maintained for consistency to relate the Program Element, Project, and Task Area Program/Budget structure to the TCP technology category and subcategory structure, and to the divisions according to functional areas. It should be the responsibility of the Military Departments and Defense Agencies to maintain consistent transfer (or transformation-matrix) functions in order that the Program/Budget subdivisions can be tracked by functional area and by TCP technology category and subcategory. (See also specific recommendation II-3.)

3. MANAGE TRAINING TECHNOLOGY R&D CENTRALLY AS PART OF HUMAN RESOURCES R&D, WITH DECENTRALIZED R&D OPERATIONS GEOGRAPHICALLY COLOCATED WITH MAJOR USERS, REPRESENTATION AT INTERMEDIATE LEVELS OF R&D AND USER COMMANDS, AND USER COMMITMENTS TO MUTUAL SUPPORT.

Interpretation

At OSD level, establish administrative review mechanisms within ODDR&E to provide centralized technology-area cognizance over all Training Technology (and Human Resources) R&D, to include not only technology-base R&D efforts, but also those system-related Training Technology R&D efforts in Advanced Development (6.3), Engineering Development (6.4), and Operational Systems Development.

In the Military Departments, centralize Human Resources R&D management at the organizational levels of the U. S. Army Research Institute for the Behavioral and Social Sciences (ARI), the Naval Personnel Research and Development Center (NPRDC), and the Air Force Human Resources Laboratory (AFHRL). Each organization should have a strong laboratory headquarters staff reporting to appropriate higher levels in the R&D chain of command. Also, it is very important that operating Training Technology R&D field units be colocated geographically with major users (e.g., in the Army at TRADOC and FORSCOM installations such as the Infantry School at Fort Benning, the Armor School at Fort Knox, USAEUR, and Fort Hood), with clear commitments to mutual user-R&D unit support, and that there be liaison or representation colocated with user command headquarters.

There is ample evidence in all the Services of the isolation of Human Factors from Training Technology R&D efforts, to the detriment of the latter. The Task Force has not studied nor assessed the impact of this separation (or its correction) on Human Factors R&D, this being beyond its charge. However, even though the Personnel and Human Factors R&D parts of Human Resources R&D were not studied in detail, it is clear that their being included in the recommended centralized management will enhance Training Technology R&D. Such centralized-management arrangements already exist to varying degrees within the Services, and the additional specific changes recommended could take the following forms:

(a) In the Army, ARI and the Human Engineering Laboratory should be managed centrally, with working representation at other Army Materiel Command agencies (e.g., PM/TRADE and the U. S. Army Training Devices Agency) to improve coordination with regard to task analyses prior to training device and equipment development and evaluation of subsequent utilization.

(b) In the Navy, the Training Technology R&D aspects of the Naval Training Equipment Center (NTEC), and the Human Factors (or Human Engineering) aspects of the Human Resources R&D efforts that are now fractionated among various Systems Commands (SYSCOM's), would be centrally managed through NPRDC. Among the operating Training Technology R&D field units that should be established, it is especially important that some be colocated with flight training centers and with operating commands.

(c) In the Air Force, the Human Resources R&D aspects of the Human Engineering Division of the Aerospace Medical Research Laboratory (AMRL) should

be managed centrally through AFHRL. Also, operating Training Technology R&D field units should be colocated with major operational users, and AFHRL representation colocated with their command headquarters (TAC, SAC, and MAC); some steps have already been taken in this direction. (Related specific recommendations include I-5, II-2, IV-1, IV-3, VI-2, VI-5, and VI-6.)

4. INCREASE TECHNOLOGY-BASE FUNDS FOR TRAINING TECHNOLOGY R&D IN SUPPORT OF CREW, GROUP, TEAM, AND UNIT (CGTU) TRAINING.

Interpretation

The vast majority of training requirements, possibly of actual training, and probably of training costs, falls in the ill-defined area of collective training in operational units--referred to herein as "Crew, Group, Team, and Unit (CGTU) Training," and elsewhere sometimes referred to as "operational training" or as "force support training." After all, most military training is applied in the operational contexts of crews, groups, teams, or units. Yet, this type of training does not generally fall under the cognizance of the Services' training organizations, nor has Training Technology R&D generally been conducted in direct support of such training requirements.

Because of these factors--the large numbers of personnel involved, the prior lack of specific attention from the training and Training Technology R&D communities, and the general advances in training technology that are now available for implementation--this is an area in which significant improvements in efficiency and effectiveness are now possible. Cost-effectiveness analyses, when they become available, will support this assertion with quantitative estimates that the Task Force is not now able to provide.

The technology-base funds for Training Technology R&D in support of CGTU Training should be increased, if necessary, with compensating reductions in the funding of other Training Technology R&D areas. They should be applied to provide a "road map" of the R&D program needed in this area, with initial efforts along two lines: (a) the identification of the characteristics of this type of training, as in the development of a taxonomy of relevant features (information transfer, skill acquisition, communications, etc.), and (b) the adapting of appropriate quantitative theoretical formulations such as process-control models.

In any event, the balance should be changed in the distribution of funds for Training Technology R&D, with a greater proportion of the technology-base funds in this area of "collective training in units." Other areas that have received greater technology-base R&D support in the past should shift towards greater funding for the implementation of findings. (See specific recommendations VI-2, VI-5, and VI-6.)

5. CHANGE ADMINISTRATIVE AND MANAGEMENT POLICIES AND PRACTICES WHEREVER POSSIBLE TO PROVIDE GREATER INSTITUTIONAL INCENTIVES FOR THE DEVELOPMENT, TRANSFER, AND USE OF COST-EFFECTIVE TRAINING TECHNOLOGY.

Interpretation

Although this may be the most difficult of the five general recommendations to put into effect, for the long run it is probably second in importance only to the needed cost-effectiveness analyses. Without progress along these lines, real progress toward nontrivial improvements in training cost-effectiveness ratios will be severely limited.

The problem, although admittedly difficult, is not impossible to solve. For example, in order to have training-subsystem requirements recognized early enough in the weapon system development cycle, they must be included as a specific requirement of the DCP/DSARC I and II process and review. Without early recognition of the impact of training subsystem considerations on total life-cycle costs of the weapon system, there is little opportunity for appropriate design trade-offs to be made.

In the Army, the TRADOC Commander has recently taken steps on a trial basis at Fort Eustis to provide realistic budgetary incentives for a School Commandant to pursue increased cost-effectiveness. Specifically, he has agreed to permit the Commandant to use all savings achieved through increased cost-effectiveness during the next two years for the further improvement of the school, the savings to be shared with TRADOC thereafter.

In all the Services, it is recognized that special pay categories and bonuses can be used successfully to acquire and retain personnel in critically needed specialties. Recognition should be given to the changes that could be made to eliminate certain disincentives that are associated with such special pay categories. For example, if flight pay were not dependent on a time-in-the-air criterion, but would be provided as well for "flying" a suitable simulator, then a major disincentive for the replacement of airborne with simulator time would have been removed (R&D could indicate the extent to which flying proficiency and combat readiness can be maintained with different mixes of airborne and simulator "flying").

It is probably only through similar changes in the incentives and disincentives that pervade the training systems of all the Services that significant progress can be made on the greatest problem of all--the opening of the systems to considerations, tests, and evaluations of real alternatives to the traditional ways of accomplishing that training which is necessary to military preparedness.

R&D resources can be used to provide some leverage in this regard, for example through the application of cost-effectiveness analyses to Training Technology

R&D program proposals that compare current and alternative training systems. ODDR&E should support R&D to improve the institutional incentives, especially as applicable to the transfer of Training Technology R&D and the adoption of cost-effectiveness criteria in deciding among training alternatives.

(Further interpretation of this general recommendation can be obtained from specific recommendations I-1, I-2, I-3, II-5, IV-6, V-3, and V-4.)

I. RECRUIT TRAINING*

Recruit Training is the initial individual training of enlisted entrants who have had no prior military service. The basic Recruit Training data for FY 1976 are given in Table 7. In terms of scope, the projections indicate nearly one-half million entering trainees and over 445 thousand graduates, with an average course length of 54 days (nearly 8 weeks), at an average cost of nearly $2900 per trained recruit. The total of nearly 67 thousand man-years to be spent in this training during FY 1976 by the trainees who will complete the course represents over 3% of projected total force strength. The total cost is projected to be nearly $1.3 billion.

The justification for undertaking Training Technology R&D for Recruit Training is threefold: (a) all enlisted persons experience it, (b) this phase of training involves indoctrination into the military service, and preparation for later training, and ultimately operational capability, and (c) the cost of this training is considerable because of the large number of trainees involved and the sizable attrition rates among first-term personnel.

All indications are that the training commands have attended to these matters to some extent over the years, but that the R&D communities of the Services have had different degrees of involvement. The Air Force reported no such research, the Navy sporadic, and the Army reported sustained involvement with an emphasis on instructional methods and evaluation procedures.

Training Technology R&D requirements for Recruit Training have emphasized improvement of the existing system within fairly constrained limits. The quality of requirements reflects the degree of interaction between the R&D community and the training commands.

The impact of Training Technology R&D for Recruit Training parallels the R&D investment made by the Services. In addition to the sustained effort, utilization of Training Technology R&D seems to require some group or agency performing the transfer function.

That Training Technology R&D can make a contribution to Recruit Training appears clear. Why this potential has not been fully realized is not so clear. Some of the factors that inhibit such realization are discussed in the chapter on this topic in the full report of the Task Force, and they are reflected in the recommendations that follow below. In addition, the recommendations focus on the generation of Training Technology R&D requirements, program development, and required areas of Training Technology R&D applicable to Recruit Training.

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*Howard H. McFann

TABLE 7

RECRUIT TRAINING, FY 1976[a]

	Army	Navy	Marine Corps	Air Force	DoD Total
Input (No. of Trainees)[b]	232,540	103,108	57,320	83,627	476,595
Attrition[b]	10,090	10,417	4,469	5,996	30,972
Output (No. of Graduates)[b]	222,450	92,691	52,851	77,631	445,623
Course Length (Days)[c]	49	63	77	42	54.1[d]
Graduate-Trainee Man-Years[e]	30,278	16,221	11,304	9,057	66,967
Number of Locations[f]	10	3	2	1	16
Median Student Load per Location (Number)[f]	1,735	5,852	7,656	10,833	4,750
Total Costs (in $ Millions)					
a. Student Pay & Allowances	312.6	155.8	119.3	70.8	658.5
b. Other Training Costs	459.2	57.5	56.8	58.2	631.7
c. Total	771.8	213.3	176.1	129.0	1,290.2
Expenditure per Graduate (in $)					
a. Student Pay & Allowances*					1,478
b. Other Training Costs*					1,418
c. Total*					2,895
Expenditure per Graduate Trainee Day (in $)[g]					
a. Student Pay & Allowances*					27.32
b. Other Training Costs*					26.21
c. Total*					53.51

*Cross-Service comparisons of these aggregated relations are not valid without adjustments to allow for accounting differences, program variations, different rates of attrition, and other variables.

[a] Males and females, active and reserves, combined.
[b] Military Manpower Training Report for FY 1976, pp. III-3 and III-4; "Attrition" by subtraction (Input minus Output).
[c] Ibid.; p. III-9.
[d] Weighted average, sum across Services of Output times Course Length (output days), divided by DoD Output (total graduates).
[e] Output times Course Length, divided by 360; does not add to DoD total because of rounding.
[f] Ibid.; p. IX-4.
[g] Ibid.; p. X-3.

Recommendations

I-1. PROCEDURES should be modified to ensure that trainee evaluation occurs by demonstrating proficiency and not time. DoD should request that modifications be made in Public Law 82-51, which currently utilizes time-in-training as the criterion of preparedness.

I-2. EXISTING administrative systems should be modified to provide greater incentives to utilize R&D findings. In Recruit Training, the major change needed is to allow the command to share in savings accrued through innovations in training. Procedures that allow the R&D community to share in savings resulting from implementation of Training Technology R&D findings (for example, cost reimbursement for R&D personnel engaged in implementation activities), should be provided without reduction in the technology-base level of funding.

I-3. ALTERNATIVE procedures to ensure greater likelihood of initial implementation and maintenance of changes initiated should be developed and tested. Two alternatives suggested are (a) the establishment of an R&D "broker" whose primary responsibility would be to interface with the R&D and Recruit-Training communities, and (b) the commitment of a proportion of R&D personnel to an implementation role on a cost-reimbursable basis.

I-4. EACH of the Services should identify and maintain Training Technology R&D for Recruit Training on a sustained basis. Especially required are longitudinal studies to determine the relationship of content and procedure to later success and performance in the Services.

I-5. PRESENT procedures for formulation of Training Technology R&D requirements and program development should be modified to provide greater involvement in these of the R&D community in Recruit Training, accompanied with responsibility, authority, and accountability.

I-6. FOR Recruit Training Technology R&D, a lead-Service approach should be established for selected Exploratory Development (6.2) activities, and the assignment of initiative and leadership roles made to specific Services in R&D areas such as literacy, physical fitness, and attitude development. The implementation of R&D findings should be left to each Service.

II. SPECIALIZED SKILL TRAINING*

Specialized Skill Training concerns the individual training given after initial-entry training of both officer and enlisted personnel to provide new or higher levels of skills and knowledge required to match specific military job requirements. The amount of such training projected for FY 1976 is shown in Table 8. It includes only the initial specialized skill, progression and functional skill training of individual officer and enlisted Service members in formal courses conducted by organizations whose predominant mission is training. This does not include on-the-job training (OJT), the training of recruits or crews, officer acquisition or flight training, or professional development education.

More than 1.25 million Service personnel are projected to enter such training during FY 1976 at a total cost of more than $3.5 billion. More than 7100 courses are offered, with an average course length of 43.5 days (more than 6 weeks), at an average cost of about $3000 per graduate. Nearly 1.2 million Service personnel are expected to complete one or more courses during the year, and the total time spent in this training by those who graduate represents over 143 thousand man-years of military effort.

The annual budget for technology-base RDT&E on education and training is about $28 million for FY 1975 and about $32 million has been requested for FY 1976. Although it has been estimated that about 40% of these funds apply to R&D on Specialized Skill Training, precise identification has not been possible. Training is not categorized in the same way in the Human Resources Technology Coordination Paper (TCP) and in the Military Manpower Training Reports. The "education and training" category of the TCP includes, but does not identify R&D on Specialized Skill Training, which is, of course, one of the categories in the manpower report.

Virtually all methods of training are used by the Services. There is a current emphasis on self-paced training; computer-aided instruction is increasing rapidly. These are important and effective technological innovations, but most instruction is still instructor-centered rather than student-centered. Only a limited review has been made herein of the content and relevance of information taught in these courses. Steps are being taken to improve the usefulness of knowledge taught and to ensure, by objective means, that the trainees have achieved the performance standards for completion.

These innovations in training are the result of R&D efforts that are regarded as relevant and effective, and that are still in various stages of development and evaluation. Current problems in skill training concern the evaluation and application of reasonably well-known results of previous and current R&D. This applies, generally, to such products as computer-managed instruction, the proper use of simulators, simplified course materials and manuals, and proceduralized job performance aids. However, there is almost a complete absence of efforts to evaluate

*Jesse Orlansky

TABLE 8

SPECIALIZED SKILL TRAINING, FY 1976[a]

	Army	Navy	Marine Corps	Air Force	DoD Total
Input	365,121	648,748	58,355	128,140	1,254,400
Attrition	26,298	28,217	5,121	6,450	66,086
Output	338,823	620,567	53,234	175,690	1,188,314
Average Course Length (Days)[b]	68.0	22.3	84.7	58.7	43.5
Graduate-Trainee Man-Years[c]	64,033	38,362	12,528	28,643	143,566
Number of Locations	28	34	15	7	88[d]
Number of Courses	619	3,212	835[e]	2,448	7,114[e]
Total Costs (in $ Millions)					
a. Student Pay & Allowances	583.9	481.5	85.0	235.2	1,385.6
b. Other Training Costs	1,303.1	397.0	69.4	397.1	2,166.6
c. Total	1,887.0	878.5	154.4	632.3	3,552.2
Expenditure per Graduate (in $)					
a. Student Pay & Allowances*					1,166
b. Other Training Costs*					1,823
c. Total*					2,989
Expenditure per Graduate Trainee Day (in $)					
a. Student Pay & Allowances*					26.81
b. Other Training Costs*					41.92
c. Total*					68.73

*Cross-Service comparisons of these aggregated relations are not valid without adjustments to allow for accounting differences, program variations, different rates of attrition, and other variables.

[a] Data of Military Manpower Training Report for FY 1976, pp. V-1 to V-15, IX-6 to IX-8, X-3; includes male and female, active and reserve, enlisted and officer combined. "Attrition" by subtraction (Input minus Output).

[b] Weighted average.

[c] Output times Course Length, divided by 360

[d] Includes 4 joint schools.

[e] Includes courses conducted by the Navy and other Services programmed for attendance by Marines.

the benefits and costs of various methods of Specialized Skill Training and to adjust accordingly the budgets for R&D on training technology. Although the R&D efforts are competent, per se, the failure to gather and analyze cost and performance data is a serious oversight that must be remedied.

Recommendations

II-1. INCORPORATE cost-benefit analyses of training procedures and equipments as a method of evaluating the R&D program on training technology in the Human Resources Technology Coordination Paper (TCP). To be meaningful, this procedure should obviously apply to all other major areas of this TCP.

II-2. INCREASE the assignment of R&D personnel, as detachments or divisions, to major Specialized Skill Training bases. R&D personnel should also be assigned, on a liaison basis, to more operational commands.

II-3. REVIEW the categories applicable to R&D on Specialized Skill Training in the TCP and those on loads and costs in the Military Manpower Training Reports with a view to making them more comparable. The purpose to be served is to improve the ability to relate allocation of effort in various types of R&D on training technology to areas of major impact on the conduct of training.

II-4. INCREASE the number of manpower economists and cost analysts in the Training Technology R&D establishments.

II-5. INCREASE the amount of Exploratory Development (6.2) discretionary funds allocated to technical directors for their use in promoting and evaluating new ideas in Specialized Skill Training R&D by 10% to 15% each year for a three-year trial period. This increase may be derived by a proportional reduction in other 6.2 funds for R&D on Specialized Skill Training. Provide stringent review, with participation by ODDR&E, for purposes of accountability in the effective use of these funds.

III. OFFICER ACQUISITION TRAINING AND PROFESSIONAL DEVELOPMENT EDUCATION*

Officer Acquisition Training fills the Services' needs for qualified junior officers: about 17,000 new officers will be commissioned during FY 1976. About 5% ($358 million) of the DoD individual training and education budget is spent on this area. There is wide variation in the duration (e.g., 10 weeks to 4 years) and cost of particular training programs.

Professional Development Education provides intellectual and technical breadth to career officers and senior non-commissioned officers: approximately 14,000 men and women will participate during FY 1976. The cost is about 7% ($520 million) of the total DoD individual training and education budget. This type of training is provided both in civilian and in-house institutions.

Officer training and education is highly traditional. Most takes place in college-like settings with the typical approaches of lectures, seminars, and reading. There are some striking applications of innovative technology, most notably at the Air Force and Naval Academies. What is conspicuously missing, however, are data evaluating the new approaches followed in these and other centers. There are excellent opportunities to do systematic assessments on the effectiveness of officer training programs.

Professional development involves an inordinate amount of time during some officers' careers. Up to 25% of the post-commissioning years are spent in this type of activity. The corresponding time for professionals in civilian life is, we believe, much less.

Non-resident self-instruction through correspondence courses has long been used in officer and non-commissioned officer professional development, and it is receiving more command emphasis at present. There should be concern about the apparent new emphasis for two reasons: (a) there is evidence to show that generally very few people complete correspondence courses, and (b) correspondence courses place an extremely high value on verbal fluency, which may not be necessary for many enlisted occupations. There is little evidence of R&D concerned with non-resident instruction; e.g., very little is known about the cost-effectiveness of this type of training.

Most Professional Development Education is provided in a structured basis (i.e., a "lock-step" fashion), with little attention to individual differences in learning rates, motivation, and the like. Related to this is the rigid system of career progression which does not make it easily possible to accelerate the promotions and responsibilities of outstanding young officers and non-commissioned officers.

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*H. Wallace Sinaiko

There is a tendency for the Services' training managers to embrace hardware technology uncritically for training programs. Much more attention seems to be paid to "how to teach" than to "what to teach" in these programs. Sometimes "media" is confused with the educational process, i.e., the medium becomes the message; and, as often happens in the civilian sector, gimmicks and gadgets are acquired without valid justification.

There are some barriers to training innovations, many of which can be changed by administrative action; e.g., high turnover among innovators and would-be innovators; too much emphasis on short-term, immediate-payoff projects; no reward for embarking on high-risk activities; and insufficient opportunity, due to course overloads, to permit experimentation.

The importance of what one briefer aptly called "the most important variable" should be underscored: the teacher. Instructors are of primary importance, and they are likely to remain so into the indefinite future. Better military teaching can be brought about in many ways, e.g., by sensible selection and career management of teachers, good preparation in the art of teaching, rewards provided for outstanding teachers, and hardware that serves to unburden and enhance the role of the instructor. Training Technology R&D should support the teacher, not supplant him.

Recommendations

III-1. RECOGNIZE the central importance of the teacher, in all military training, and take appropriate administrative (and R&D) steps to support him. The Services should disabuse themselves of the notion that all men are equally skilled modules when they are assigned to training billets as instructors. As in recommendation III-3, below, a good deal is known about teaching skills in the civilian sector, and this literature should be applied. A less-inhibited recommendation is that special career fields in training and education should be established; perhaps the British Army's experience would be instructive in this regard.

III-2. INITIATE in-depth studies and experimental evaluations of the new training equipments that are currently being introduced into officer acquisition programs. A proportion of the budget for new types of training equipment should provide funds for evaluating their effectiveness. Existing data from other programs may be applicable in Officer Acquisition Training; these products should be rediscovered and their findings used where possible. Develop techniques and procedures that will ensure new training media will not be adopted uncritically. Require technology procurement to include quantitative evidence on anticipated benefits; cost-benefit analyses are needed before procurement, as well as in evaluations of utility after procurement.

III-3. CONDUCT research and development in the area of self-instruction, particularly the traditional correspondence course approach to training and education. Establish up-to-date data bases, for example, on course completion rates (both within and outside the Military Departments), and factors contributing to successful self-instruction (e.g., student, situational, and content variables). Initiate R&D leading to good cost-effectiveness estimates for correspondence versus other training approaches.

III-4. INITIATE comparative studies of civilian and military practices in Professional Development Education, for example, on the duration and types of training employed for maintaining and broadening professional competencies.

III-5. IN the area of Professional Development Education, determine effective lead times between training courses and duty assignments (for example, should advanced specialty education occur immediately before an officer's utilization tour, or precede it by several years?).

IV. FLIGHT TRAINING*

Flight Training, as considered here, is the individual training in basic flying skills needed to provide the Services with pilots and navigators for initial assignments to operational mission units. Flight Training data for FY 1976 are shown in Table 9. Over 10,000 Service personnel are expected to enter one or more of the score of courses that average about 200 days in duration (nearly 29 weeks) at an annual cost of more than $1.15 billion. About 9200 will graduate, so the average cost of the program per graduate is more than $125 thousand.

Undergraduate Pilot Training (UPT) in all of the Services continues to be a very expensive endeavor, but with a great potential for immediate and longer-range cost savings. Immediate cost savings could be achieved by more effective use of existing simulators and trainers, by adopting improved training methods, and by incorporating task-oriented training syllabi. Further, R&D of a direct nature in areas such as performance assessment, identification of job-relevant skills, training methods, and concepts, training-equipment design and utilization, and management methods should be highly productive in future cost savings. Programs of R&D in most of these areas have been designed, but many have not been initiated.

Coordination of R&D on Flight Training between and within the Services does not always take place at the working levels and places where mutual benefits could be achieved. This is in part a result of the Services not having similar organizational structures for R&D on Flight Training. While a number of coordinating committees exists, effective spreading of the word may or may not occur. New and better methods are obviously needed.

Flight Training R&D management appears to be too remote from either training or operational command headquarters (or both, in certain instances). If the R&D managers are too distant from the training scene, understanding of the environment, procedures, problems, and objectives of the training programs will be less than desirable in the establishment of priorities, approval of levels of support, and provision of proper guidance to the R&D program. Likewise, to the extent that Flight Training R&D units are permitted to be physically remote from the intended users of their products, so will the probabilities be low of their making significant and timely contributions to the users' programs.

Present methods for establishing, prioritizing, and processing R&D requirements for Flight Training leave much to be desired. Since there is no independent evaluation of Service-specific requirements, institutional biases can filter out what might be a highly productive program.

The successful work of the Navy's Training Analysis and Evaluation Group (TAEG) has led to the application of advanced training technology to several Flight Training programs with concomitant savings of many millions of dollars and

*Ralph Flexman

TABLE 9

FLIGHT TRAINING, FY 1976[a]

	Army	Navy	Marine Corps	Air Force	DoD Total
Input	2,105	1,905	1,285	5,125	10,420
Attrition	385	415	75	327	1,202
Output	1,720	1,490	1,210	4,798	9,218
Average Course Length (Days)[b]	136.9	338.0	162.6	190.7	200.8
Graduate-Trainee Man-Years[c]	654	1,399	547	2,542	5,142
Number of Locations	1	7	5	12	25
Number of Courses	1(+)	14	0[d]	5	20(+)
Total Costs (in $ Millions)					
a. Student Pay & Allowances	16.9	31.5[e]	12.7	34.8	95.9[e]
b. Other Training Costs	90.5	364.8[e]	44.1	558.8	1,058.2[e]
c. Total	107.4	396.3[e]	56.8	593.6	1,154.1[e]
Expenditure per Graduate (in $)					
a. Student Pay & Allowances*					10,404
b. Other Training Costs*					114,797
c. Total*					125,201
Expenditure per Graduate Trainee Day (in $)					
a. Student Pay & Allowances*					51.81
b. Other Training Costs*					571.74
c. Total*					623.56

*Cross-Service comparisons of these aggregated relations are not valid without adjustments to allow for accounting differences, program variations, different rates of attrition, and other variables.

[a] Data of Military Manpower Training Report for FY 1976, pp. VI-1 to VI-14, excludes Flight Familiarization Training, and computed on the assumption that the average course length for the reported category of "Other Flight Training" is uniformly 4.5 weeks in duration. "Attrition" by subtraction (Input minut Output).

[b] Weighted average.

[c] Output times Course Length, divided by 360.

[d] Included in Navy total.

[e] Includes $26.9 million for the carrier USS LEXINGTON, which supports carrier landing and take-off training.

conservation of scarce resources. They incorporate the services of an interdisciplinary team capable of performing cost analyses in their restructuring of existing training programs.

A problem existing to a greater or lesser degree in all Services is the dependence on favorable management attitudes for the initiation, support, and application of Flight Training R&D. It is not infrequent that programs of great potential are either ignored or successfully opposed because of institutional biases and opinions based on less than fully relevant experiences. There is little doubt but that strong biases prevented the expanded use of flight simulators at an earlier date in the Services. Perhaps because of the lack of a rigorous system that places accountability on the decision makers (and those assigned responsibility for management and supervision of R&D applications), it has been relatively easy to withdraw support of a program at almost any stage. Also, rotation of military personnel has had a profound and negative effect on the continuity of support to R&D and to its successful applications. However, since rotation is a major feature of career growth in the Services, and since civilian influence is minimal in the area of military Flight Training, changes will be difficult to achieve other than through an educational and evolutionary process.[13/]

R&D in direct support of UPT has been primarily concerned with the design and development of training equipment, with insufficient emphasis on the development of innovative concepts and strategies. Proper analysis of future training requirements has been slow in evolving, and most Training Technology R&D has been reactive rather than innovative. Again, the emphasis appears to be disproportionately focused on "how to teach" rather than on "what to teach."

Recommendations

IV-1. FLIGHT-TRAINING programs and Flight Training R&D of the four Services should be closely coordinated at the OSD level. Simulator development and utilization should be monitored closely and cost-effectiveness analyses made of individual, crew, and unit Flight Training, with comparisons of alternate approaches (a) to Flight Training, (b) to the use of simulators and other advanced training technology in such training, (c) with comparisons of differences among the Services, and (d) between U. S. and foreign Flight-Training programs. A level of effort at OSD of between 2 and 4 professional man-years per year is believed necessary to accomplish these functions.

IV-2. ESTABLISH a joint-Service R&D capability colocated with the Air Force Tactical Air Command (TAC) at Luke Air Force Base for management and utilization of advanced-concept flight simulators, such as the simulator for air-to-air combat (SAAC) and the F-4 simulator with air-to-ground visual capability, both currently located at Luke Air Force Base. The exceptionally high capital investment and operating costs of these flight simulators

that are uniquely suited for Flight Training R&D makes relevant and full utilization of such equipment a cost-effective management goal. The basic commonality of training and mission tasks in Service flying makes desirable the joint use of such facilities. Thus, similar organization, management, and utilization should be planned, or where existing (e.g., the Navy representation at Williams Air Force Base) should be continued, for all major Flight Training R&D simulators and facilities such as ASUPT (Air Force), AWAVS (Navy), and SFTS (Army).

IV-3. COLOCATE Flight Training R&D units with training or operational flying units and require representation of Flight Training R&D personnel at the user command headquarters.

IV-4. BOTH the Army and the Air Force should establish TAEG-type units.

IV-5. ALL Services should place the highest possible standards on the selection and assignment of training and training-R&D managers at all levels. The establishment of suitable pre-assignment training should be instituted to assist in the transition of line officers to becoming competent managers of training and training R&D, much as similar pre-assignment training is provided in the case of PM/SPO assignments. Further, where exceptional competence has been demonstrated, tours of duty should be extended without negative impact on the individual's career progression.

IV-6. DEVOTE a substantial proportion of Flight Training R&D funds to longer-range programs that deal with innovative concepts such as the development of (a) ways in which ROTC training might provide both wings and a commission at graduation, and (b) innovative uses of flight simulators so that civilian-trained pilots might be attracted in sufficient numbers and trained by simulator at dispersed sites in major cities to qualify for certain types of transition training beginning with their first day in the Service.

V. WEAPON SYSTEM TRAINING SUBSYSTEM DEVELOPMENT*

A weapon system (such as an aircraft or a missile) is an instrument of combat including all the related equipment, supporting facilities, and services required to deliver it to its target or permit it to be used in carrying out the mission for which it was built. Thus, during the early development stages of a new weapon system, work should be (and is supposed to be) initiated to define the system's training subsystem--i.e., those categories of training (skills and equipment) that are required to support the weapon system. This is supposed to be an orderly process by which the tasks required to operate, maintain, and control the system are identified, and by which plans are developed for acquiring the necessary skilled personnel to perform these tasks. What should happen seldom does happen, and there is a clear need for a common methodology that provides visible and reliable estimates and accounting of weapon system training subsystem costs.

The training subsystem's impact on total life-cycle costs of the weapon system should be computed on a continuing basis, especially during the earlier design and development stages so that appropriate design trade-offs can be made to reduce the system's total life-cycle costs. However, current requirements do not provide sufficient incentives to the PM/SPO to give appropriate consideration to training requirements and analyses early in the system-development process. In addition, a positive mechanism or directive is needed that will ensure the development by the Training Technology R&D community of comparative, quantitative analyses to support weapon-system training subsystem decisions.

Recommendations

V-1. TASK appropriate DoD agencies to develop a common methodology that will provide visible and reliable estimates and accounting of weapon-system training subsystem costs. The technique should permit decision-makers to evaluate the impact of these cost elements on the life-cycle operating costs of the weapon system.

V-2. DEVELOP AND COLLATE those data and costs associated with the planning and implementation of the training subsystem portion of weapon systems typically assigned to each of the Services. These data should be organized with the view that they are to be furnished to planners and designers (both military and contractor) for use in trade-off analyses, evaluation of alternative designs, cost-effectiveness analyses, and computation of life-cycle costs.

V-3. INCORPORATE training subsystem requirements and planning (e.g., SAT/ISD) as a specific requirement of the DCP/DSARC I and II process and review.

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*O. S. Adams

V-4. DESIGNATE, within each Military Department, a portion of the appropriate R&D agency's effort for R&D related to innovative application of training technology that would reduce weapon system life-cycle costs and make more-efficient use of system manpower. Funding of the R&D effort should be on a cost-reimbursable basis paid by the PM/SPO. A joint planning and approval process involving both the PM/SPO and the R&D agency should be developed for all Training Technology R&D programs funded under such an arrangement.

VI. CREW, GROUP, TEAM, AND UNIT (CGTU) TRAINING*

Technically and financially, and unlike individual training, CGTU Training is embedded in the operating forces--it is the collective training of elements of those operating forces. Depending on the circumstances, what these forces do may be defined as training or as operating. Assumptions can be made that personnel learn while operating, and that operating is therefore training. This assumption is only partly true. Some members of the force may be learning while operating. Others may not be learning. This circumstance of embeddedness made it difficult to identify, for the purposes of this study, what the Services do recognize as CGTU Training, or to obtain corollary data on student loads and training costs.

After discussions with the Services' representatives, it was agreed that the scope of CGTU Training would be limited to that in which a formally recognized training syllabus is used, and which is conducted in formally recognized courses. Everyone in these discussions agreed that, although this definition would make it possible to supply reliable information, it would exclude a very large training-while-operating domain--only the tip of the iceberg above water would be identified. CGTU Training costs have not been included to date in the annual Military Manpower Training Reports. This results in less visibility for these costs, which must be very great by any method of reckoning.

CGTU Training is managed differently than individual training. This is potentially inefficient because assignments, schedules, training procedures and objectives may not be well coordinated between the two and could result in overlap or gaps with consequent inappropriate use of training resources.

Despite the magnitude of CGTU Training in the Services, there is very little R&D on CGTU Training at the present time. Also, there are marked differences among the services with regard to stated requirements for CGTU Training R&D. The Army (TRADOC) is currently emphasizing the need for and importance of Training Technology R&D in this area.

Relatively recent advances in hardware technology, such as the laser, the digital data-processing system, and large-scale integration (LSI) of digital circuits, constitute potentials for improving some types of CGTU Training. Lasers can reduce the costs of training by providing low-cost fire-control simulators. Digital data-processing systems can be used to obtain control over training processes. LSI devices can provide, through microprocessors and minicomputers, the same kind of revolutionary change in control and computational applications that they are making in the civilian sector. They offer great promise for similar impact on computer-based instruction and on certain types of simulators.

There is a wide range of requirements for CGTU Training R&D from (a) routine but important servicing of user needs and R&D on training-system variables,

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*Joseph Rigney

to (b) the generation and nurturing of bright ideas that may offer substantial improvements in performance and/or reductions in cost.

Recommendations

VI-1. INITIATE systematic R&D to develop a taxonomy of operational force elements (crews, groups, teams, and units), and on methods for controlling training variables in the context of process-control models. This R&D should have first priority to establish a framework for subsequent, programmatic R&D on CGTU Training.

VI-2. ESTABLISH CGTU Training R&D testbeds in all four Services, as cooperative efforts between R&D and user communities. Provide the necessary critical mass of resources and continuity of effort to develop more cost-effective ways of training the different kinds of operating-force elements (CGTU's) characteristic of each Service.

VI-3. INCORPORATE instructional technology into flight and other simulators, to improve the effectiveness of these devices for training, and to increase their utility. The Training Technology R&D elements of NPRDC and NTEC (in the Navy), of ARI (in the Army), and of AFHRL (in the Air Force), should be tasked and funded to develop the instructional technology and the delivery systems to be used with these simulators. These laboratories should also participate in the initial planning for the simulators, with the responsibility for contributing the training technology implementation and utilization plans.

VI-4. INITIATE R&D on methods for identifying the influence and interaction of the present systems for managing training, personnel, and hardware design so that they can be coordinated to prevent or reduce suboptimization effects on CGTU Training and operations.

VI-5. ORGANIZE the Human Resources Laboratories in the Services to manage Training Technology R&D centrally, with decentralized R&D operations co-located with CGTU operational training.

VI-6. TRAINING Technology R&D agencies in the Services should examine interfaces between individual and CGTU Training to improve coordination of objectives, methods, scheduling, training concepts, and funding.

NOTES

1. Schlesinger, James R. Annual Defense Department Report, FY 1975. Pp. 197-8.

2. Currie, Malcolm R., Memorandum for the Chairman, Defense Science Board, Subject: "Training Technology," dated 3 June 1974.

3. Department of Defense. Military Manpower Training Report for FY 1975 (dated March 1974), and Military Manpower Training Report for FY 1976 (dated March 1975).

4. Task Force meetings were held in the facilities of the Institute for Defense Analyses on 23 July 1974 (Task Force Organization), 17-18 September 1974 (Flight Training), 15-16 October 1974 (Weapon System Training Subsystem Development), 25-26 November 1974 (Recruit Training), 16-18 December 1974 (Specialized Skill Training), 21-22 January 1975 (CGTU Training), 18-19 February 1975 (Officer Acquisition Training and Professional Development Education), 17-19 March 1975 (Task Force Review of Preliminary Draft Report), and 20-21 May 1975 (Task Force Revision and Preparation of Final Draft Report).

5. FY 1964 through FY 1975 from Schlesinger, James R., Annual Defense Department Report, FY 1975, pp. 21, 235, 237. FY 1976 from Schlesinger, James R., Annual Defense Department Report, FY 1976, pp. D-1, D-3.

6. From Schlesinger, James R., Annual Defense Department Report, FY 1976, pp. IV-14, D-1.

7. From DoD, Military Manpower Training Report for FY 1976, Appendix D.

8. From Allen, John L., "Presentation to Defense Science Board," dated 18 April 1974, p. 2.

9. Data of Tables 7 and 8.

10. From Schlesinger, James R., Annual Defense Department Report, FY 1975, p. 198.

11. DoD RDT&E data from Currie, Malcolm R., The Department of Defense Program of Research, Development, Test and Evaluation, FY 1976 (dated February 1975), Appendix, pp. A-2, A-5. Human Resources and Training Technology (or "Education and Training") R&D data from the Military Assistant for Human Resources (21 May 1975).

12. If it is assumed that the nontechnology-base programs of Training Technology R&D and of DoD RDT&E are proportionally equivalent, and that the identified

technology-base programs of the two are exact and inclusive, then the non-technology-base part of Training Technology R&D beyond that included in the Human Resources R&D program for FY 1976 may be estimated as follows:

$$X = [(8626.1)(32.4)/(1610.5)] - (15.1)$$

$$X = \$158.4 \text{ million.}$$

Among the known programs of this sort that were not reviewed by the Task Force are (a) an Army 6.4-element on Synthetic Flight Training Systems (SFTS) managed through the Assistant Director (AD) for Air Mobility, (b) an Air Force 6.4-element on Digital Radar Land Mass Simulators (DRLMS; AD for Combat Support), (c) an Air Force 6.3-element on a Simulator for Air-to-Air Combat (SAAC; AD for Air Warfare), and (d) a recently cancelled Air Force 6.4-element on an Audio-Video Recording System (AVRS; AD for Combat Support).

13. For example, see the reviews recently requested by the House Committee on Armed Services in HR Report 94-199, "Study on Costs of Forms of Manpower," p. 75.

14. From Copeland, D. R., et al., Analysis of Commercial Contract Training, Training Analysis and Evaluation Group Report, 1974, No. 13-1, page 90.

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

17 March 1975

MEMORANDUM FOR: Dr. John L. Allen,
Deputy Director (Research and Advanced Technology)

FROM: Earl A. Alluisi, Chairman, DSB Task Force on Training Technology

SUBJECT: Report of the Committee on a Defense Training Technology Center

1. Committee members: Earl A. Alluisi, Old Dominion University (Chrm)
O. S. Adams, Lockheed-Georgia Company
Davis B. Bobrow, University of Maryland
Jesse Orlansky, Institute for Defense Analyses

This committee was charged with two questions:

(a) Should there be a Defense Training Technology Center?

(b) If so, what roles should be played in such a center by existing agencies such as the Army Training Devices Agency, the Naval Training Equipment Center, and the Air Force Simulator Systems Program Office?

2. The Committee had access to all the information collected by the DSB Task Force on Training Technology. Members of the Committee visited the Army Training Devices Agency and the Naval Training Equipment Center in Orlando, Florida, on 6 February 1975, and the Advanced Systems Division of the Air Force Human Resources Laboratory, the Simulators and Human Factors group under the Deputy for Engineering of the Aeronautical Systems Division, and the Air Force Simulator Systems Program Office in Dayton, Ohio, on 20 February 1975.

3. Findings:

(a) At the present time, there are essentially NO data regarding the cost effectiveness of the training currently employed, much less cost-effectiveness functions that would permit the comparison of the current methods with alternative training philosophies, methods, procedures, equipments, and goals. This can be interpreted as a gap at the policy level. Policy should demand the same sort of "hard" cost-effectiveness evidence with regard to training that is required for weapon systems development and acquisition.

(b) At the present time, the DoD cannot assess the true impact of alternative training systems (either in terms of cost reductions or increases, or in terms of effectiveness or influence on combat readiness), nor can the ODDR&E assess the true worth (or potential worth) of its training technology R&D program. The implication is both clear and disturbing--many important decisions are being made without an adequate, valid, quantitative basis in fact. Both better costing methods and better training-effectiveness assessment methods should be developed.

(c) At the present time, there is no compelling evidence to suggest there exist unnecessary duplications of training technology R&D efforts or that the present efforts are not relevant to Defense purposes. However, it is difficult to assess whether the distribution of these efforts is directed toward the problems of greatest potential benefit. The appropriate cost-benefit analytical methods should be developed, and the necessary data bases collected.

(d) The lag in implementation by the training and operational commands and the weapon system program offices of the training technology R&D findings can be attributed largely to insufficient contacts between the R&D and user communities. The most successful instances of appropriate implementation have occurred where training technology R&D work has been co-located with its user, and such colocation should be continued and encouraged in the future.

4. Recommendations:

(a) In response to question "a," and especially in view of finding "d," we do not recommend the establishment of a Defense Training Technology Center for the conduct of training technology R&D. We have not considered the feasibility of such centralization for the acquisition of nonsystem training equipment, nor for the performance of the logistics of training equipment storage, maintenance, etc. Further, we have not considered the feasibility of establishing a centralized Defense agency for the program management of 6.1 (Research) funds, since it is anticipated that most of the work would be contractual rather than in-house.

(b) Granted the answer to question "a," above, question "b" is now moot. However, the Committee would like to note that its parent body, the Task Force, will have specific recommendations regarding the management and future organization of these other training technology R&D agencies.

(c) Apart from the two questions asked, and as a gratuitous recommendation based on the important findings of the Committee (and Task Force) given in 3(a) and 3(b), above, a training-technology cost-effectiveness analytical capability should be established in ODDR&E in order to support OSD missions in the areas of decisions about training and assessments of training evaluations, such capability to be coordinated with related functions in ASD(M&RA), ASD(I&L), and ASD(P&AE).

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

22 May 1975

MEMORANDUM FOR: Dr. John L. Allen,
Deputy Director (Research and Advanced Technology)

FROM: Earl A. Alluisi, Chairman, DSB Task Force on Training Technology

SUBJECT: Report of the Committee on the Navy AWAVS Location

1. Committee members: Earl A. Alluisi, Old Dominion University (Chrm)
Davis B. Bobrow, University of Maryland
Ralph E. Flexman, University of Illinois
Joseph W. Rigney, University of Southern California

2. Upon request, the utilization plan of the Navy's Aviation Wide-Angle Visual System (AWAVS) was reviewed by a special committee of the DSB Task Force with the view of making a specific recommendation concerning the proper physical location of this R&D capability (see Attachment 1).

3. Based on the information presented to the Task Force by Navy representatives and on review of the Utilization Plan, we recommend that:

(a) The AWAVS be colocated with a Naval Flight Training Unit to be determined by the Navy, but consistent with the planned AWAVS utilization and with the Training Technology Task Force general recommendation number 3.

(b) A flight training R&D capability be established within existing resources of the following Navy Human Resources R&D organizations: Naval Training Equipment Center (NTEC), Naval Personnel Research and Development Center (NPRDC), Naval Aviation Medical Research Laboratory (NAMRL), colocated with the AWAVS and the Naval Flight Training Unit, designated by the Navy as per paragraph 3(a), above.

Attachment *

*Attachment not included here.